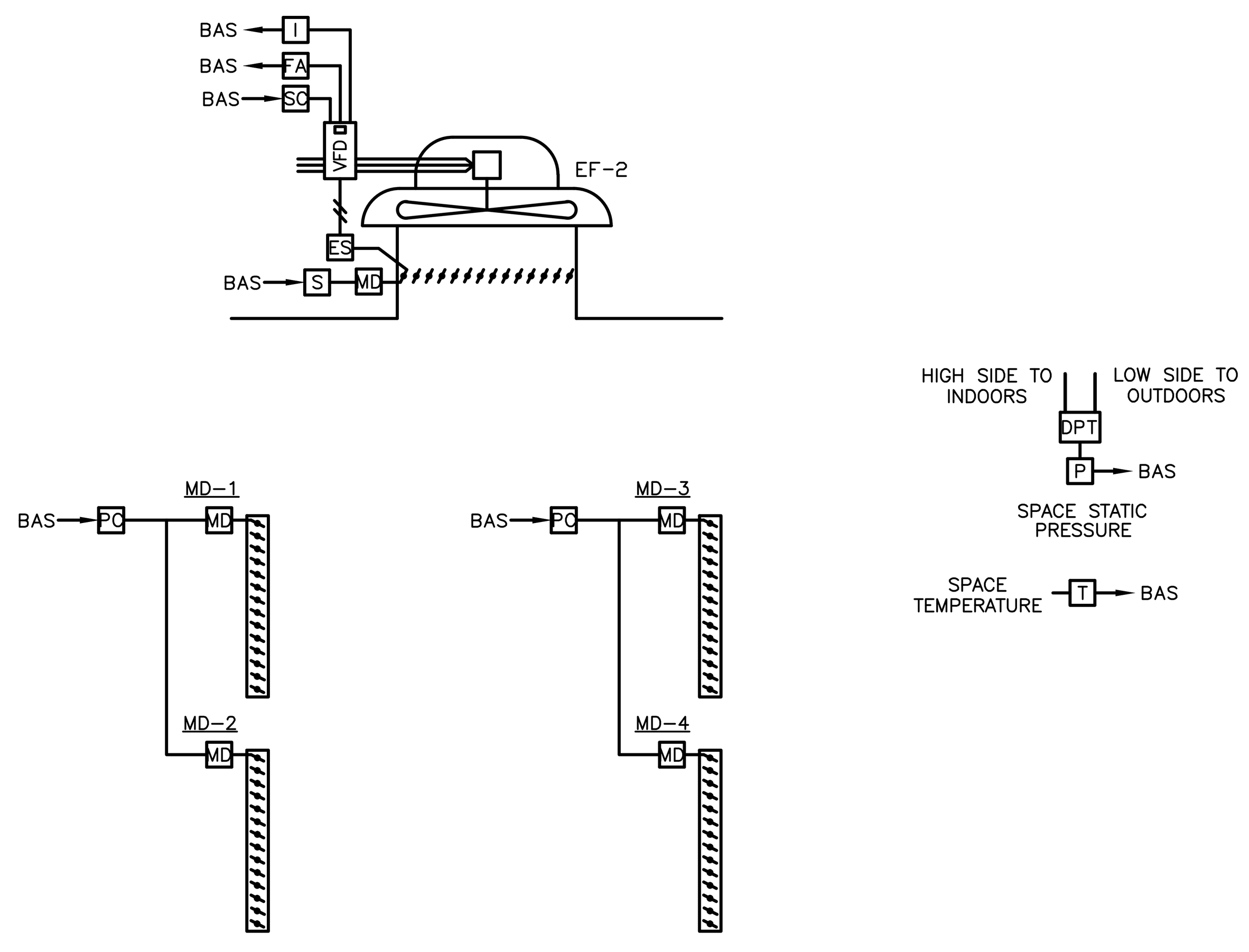
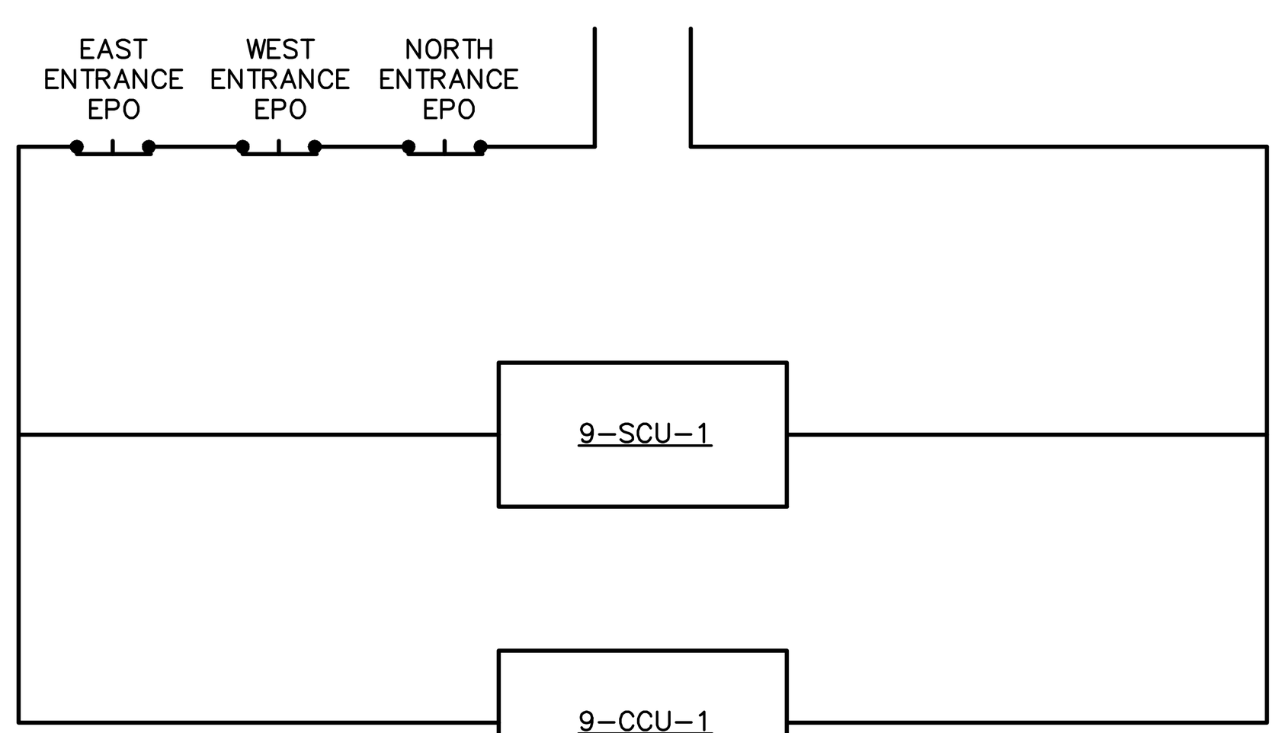
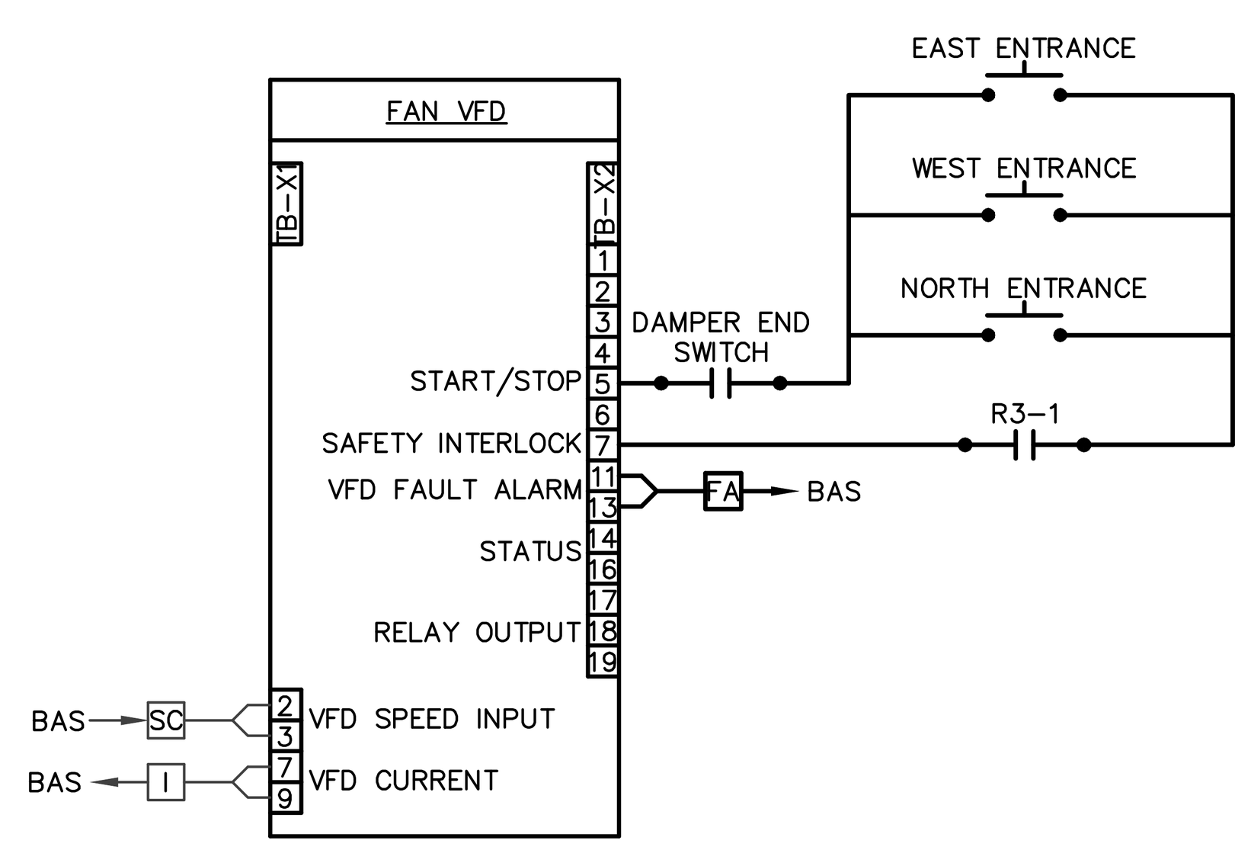


EXHAUST FAN (9-EF-2) CONTROL



CHILLER OFF ONLY CONTROL



VFD WIRING DIAGRAM

SEQUENCE OF OPERATION (9-EF-2)

GENERAL: THE REFRIGERANT MONITOR SHALL BE A MULTIPOINT UNIT WITH 4 SENSING PORTS. THE REFRIGERANT MONITOR RM-1 SHALL COMMUNICATE WITH THE BUILDING AUTOMATION SYSTEM (BAS) VIA RS-232 COMMUNICATIONS INTERFACE. THE REFRIGERANT MONITOR COMMON WARNING, AND ALARM CONTACTS SHALL BE HARD WIRED TO THE BAS. THE REFRIGERANT MONITOR SHALL HAVE COMMON CAUTION, COMMON WARNING AND COMMON ALARM CONTACTS FOR THE CHILLER ROOM AUDIBLE AND VISUAL ALARM CONTROL. THE FOLLOWING IS THE SEQUENCE OF OPERATION FOR THE SYSTEM.

GENERAL: AN ELECTRONIC ANALOG REFRIGERANT SENSOR SHALL SEND A SIGNAL TO THE BAS WHICH IS LINEAR WITH RESPECT TO THE REFRIGERANT CONCENTRATION SENSED. IN THE EVENT THE REFRIGERANT CONCENTRATION RISES ABOVE 250PPM, THE EMCS SHALL SIGNAL A WARNING CONDITION. IN THE EVENT THE REFRIGERANT CONCENTRATION RISES ABOVE 1,000 PPM, THE EMCS SHALL SIGNAL AN ALARM CONDITION.

WARNING CONDITION: IN THE EVENT OF A WARNING CONDITION (ABOVE 250PPM), THE REFRIGERANT MONITOR SHALL ENERGIZE THE AMBER WARNING STROBE LIGHTS INSIDE AND OUTSIDE THE REFRIGERATION MACHINERY ROOM.

ALARM CONDITION: IN THE EVENT OF AN ALARM CONDITION (ABOVE 1,000PPM), THE REFRIGERANT MONITOR SHALL ENERGIZE THE RED ALARM STROBES AND ALARM SIRENS INSIDE AND OUTSIDE THE REFRIGERATION MACHINERY ROOM.

SIREN SILENCE PUSHBUTTON: THE SIRENS SHALL BE SILENCED THROUGH A PUSHBUTTON SWITCH IN THE BOILER PLANT WHEN THE ALARM IS ACKNOWLEDGED.

VARIABLE FREQUENCY DRIVE: THE VARIABLE FREQUENCY DRIVE SHALL BE INTEGRATED TO COMMUNICATE WITH THE BUILDING AUTOMATION SYSTEM THROUGH A BACNET INTERFACE.

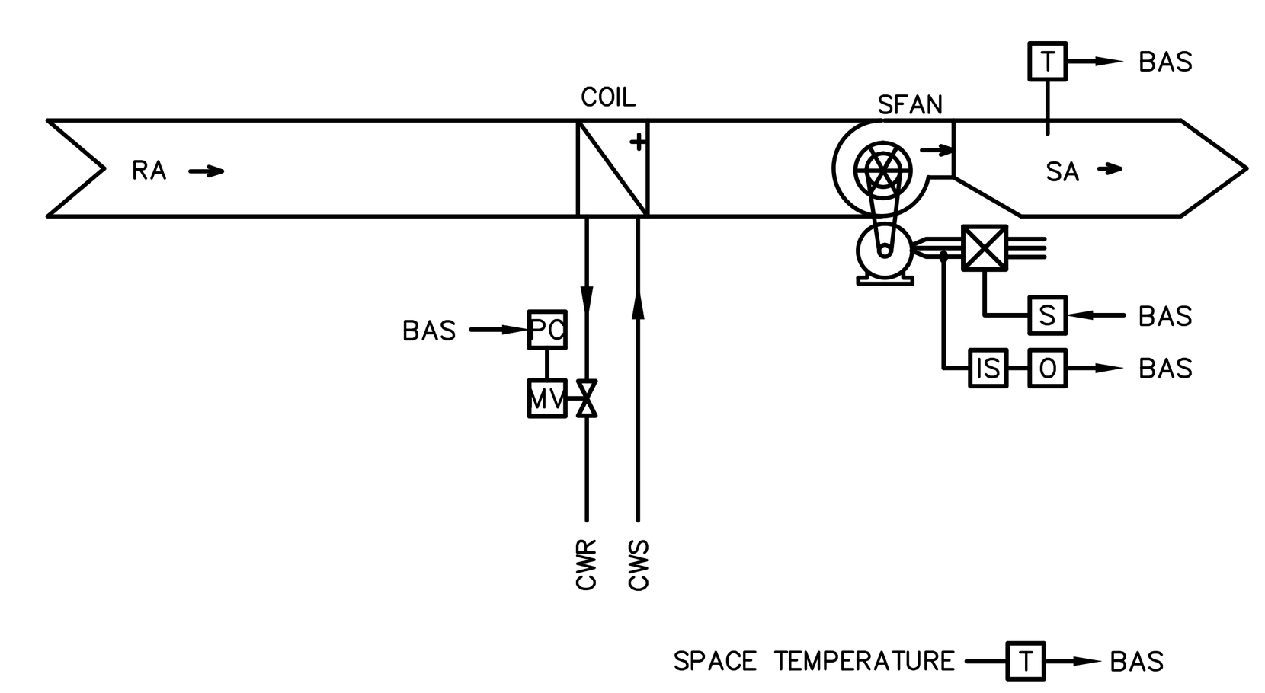
EXHAUST FAN START/STOP CONTROL: THE EXHAUST FAN SHALL HAVE A HAND-OFF-AUTO SWITCH. WHEN IN THE "HAND" POSITION, THE MOTORIZED CONTROL DAMPER SHALL OPEN. WHEN IN THE "OFF" POSITION, THE MOTORIZED CONTROL DAMPER SHALL CLOSE. WHEN IN THE "AUTO" POSITION THE MOTORIZED CONTROL DAMPER SHALL BE CONTROLLED BY THE BAS. THE EXHAUST FAN SHALL BE INTERLOCKED THRU THE DAMPER END SWITCH TO OPERATE WHEN THE DAMPER IS OPEN. PROGRAM THE BAS TO OPEN THE DAMPER AT ALL TIMES.

EXHAUST FAN STATUS: A FAILURE OF THE FAN AS DETERMINED BY AN ANALOG CURRENT TRANSDUCER SHALL, THROUGH THE DDC CONTROLLER, ISSUE A STOP COMMAND AND SIGNAL THE BAS OF A FAN FAILURE.

EXHAUST FAN SPEED CONTROL: THE MINIMUM EXHAUST FAN SPEED SHALL BE SET DURING BALANCING TO PROVIDE A MINIMUM OF 1,610CFM OF EXHAUST FROM THE CHILLER ROOM. ELECTRONIC ANALOG TEMPERATURE SENSORS LOCATED OUTSIDE AND IN THE SPACE SHALL THROUGH THE DDC CONTROLLER, CONTROL THE EXHAUST FAN SPEED. IN THE EVENT THAT THE OUTSIDE AIR TEMPERATURE IS ABOVE THE SPACE TEMPERATURE, THE EXHAUST FAN SPEED SHALL REMAIN AT ITS MINIMUM. IN THE EVENT THAT THE OUTSIDE AIR TEMPERATURE IS BELOW THE SPACE TEMPERATURE, THE BAS SHALL MODULATE THE EXHAUST FAN SPEED TO MAINTAIN THE SPACE SETPOINT TEMPERATURE. IN THE EVENT THE BAS RECEIVES A REFRIGERANT ALARM CONDITION FROM THE REFRIGERANT MONITORING PANEL, THE BAS SHALL RAMP THE EXHAUST FAN SPEED TO 100%.

OUTSIDE AIR DAMPER (MD-1 & 2) CONTROL: A SPACE MOUNTED ANALOG STATIC PRESSURE SENSOR/TRANSMITTER SHALL, THROUGH THE DDC CONTROLLER, CONTROL THE OUTSIDE AIR DAMPERS. IF THE SPACE STATIC PRESSURE RISES ABOVE -0.05 INCHES WATER COLUMN, THE DDC CONTROLLER SHALL MODULATE THE OUTSIDE AIR DAMPER CLOSED. IF THE SPACE STATIC PRESSURE FALLS BELOW -0.05 INCHES WATER COLUMN, THE DDC CONTROLLER SHALL MODULATE THE OUTSIDE AIR DAMPER OPEN.

OUTSIDE AIR DAMPER (MD-3 & 4) CONTROL: OUTSIDE AIR DAMPERS (MD-3 & 4) SHALL BE CLOSED UNLESS MANUALLY OVERRIDEN AT THE BAS.



FAN COIL UNIT (9-FCU-1) CONTROL SCHEMATIC

SEQUENCE OF OPERATION (FAN COIL UNIT (9-FCU-1))

1. **GENERAL:** ALL SETPOINTS SHALL BE FULLY ADJUSTABLE AND SHALL BE ACCESSIBLE FROM THE BAS OPERATOR INTERFACE.
2. **TEMPERATURE CONTROL:** A SPACE MOUNTED ELECTRONIC ANALOG TEMPERATURE SENSOR SHALL SIGNAL THE DDC CONTROLLER OF SPACE TEMPERATURE. THE SPACE TEMPERATURE SENSOR SHALL, THROUGH THE DDC CONTROLLER, MODULATE A CHILLED WATER CONTROL VALVE (FAIL IN LAST POSITION) TO MAINTAIN TEMPERATURE SETPOINT OF 74 DEGREES F. IN THE EVENT THE SPACE TEMPERATURE RISES ABOVE COOLING SETPOINT, MODULATE THE CHILLED WATER CONTROL VALVE FROM CLOSED TO OPEN.
3. **FAN CONTROL:** THE FAN COIL UNIT FAN SHALL, THROUGH THE DDC CONTROLLER OPERATE UPON A CALL FOR HEATING OR COOLING. THE FAN COIL UNIT FAN SPEED SHALL BE MANUALLY ADJUSTED AT THE FAN COIL UNIT CONTROL PANEL DURING BALANCING OPERATIONS.

I/O SUMMARY TABLE

PROJECT:
GRAND JUNCTION VAMC
REPLACEMENT OF ABSORPTION CHILLER

HARDWARE – OUTPUT / INPUT

SYSTEM/POINT DESCRIPTION	QUANTITY REQUIRED	GRAPHIC DISPLAY	OUTPUT DIGITAL: CONTROL RELAY (INSTANTANEOUS)	CONTROL RELAY (LATCHING)	OFF/AUTO	OPEN/CLOSE		OUTPUT ANALOG: 4-20 MILLIAMP	CONTROL POINT ADJUSTMENT	POSITION ADJUSTMENT	ELECTRIC-PNEUMATIC TRANSDUCER		INPUT DIGITAL: PRESSURE SWITCH	DIFFERENTIAL PRESSURE SWITCH	THERMOSTAT	CURRENT SWITCH	AUXILIARY CONTACT	STATUS CONTACT	SMOKE DETECTOR	PULSE	INPUT ANALOG: TEMPERATURE	HUMIDITY	CARBON DIOXIDE	PRESSURE	FLOW	CONDUCTIVITY	CURRENT
EXHAUST FAN EF-2																											
EXHAUST FAN DAMPER CONTROL	1	Y	X																								
EXHAUST FAN STATUS	1	Y																									X
EXHAUST FAN SPEED CONTROL	1	Y						X																			
VFD FAULT ALARM	1	Y																X									
OUTSIDE AIR DAMPER (MD-1 & 2) CONTROL	1	Y						X																			
OUTSIDE AIR DAMPER (MD-3 & 4) CONTROL	1	Y						X																			
SPACE TEMPERATURE	1	Y																			X						
SPACE STATIC PRESSURE	1	Y																						X			
REFRIGERANT WARNING	1	Y																X									
REFRIGERANT ALARM	1	Y																X									
FAN COIL UNITS (FCU-1)																											
SPACE TEMPERATURE	1	Y																			X						
FAN START/STOP	1	Y	X																								
FAN STATUS	1	Y														X											
CHILLED WATER CONTROL VALVE	1	Y						X																			
SUPPLY AIR TEMPERATURE	1	Y																			X						

HARDWARE – ALARMS / SOFTWARE – APPLICATION PROGRAMS

SYSTEM/POINT DESCRIPTION	ALARMS DIGITAL: CONTACT CLOSURE	SAFETY SHUTDOWN		ALARMS ANALOG: HIGH LIMIT	LOW LIMIT	RUN TIME	SCHEDULED START/STOP	OPTIMUM START/STOP	EVENT	TEMPERATURE CONTROL	DAY/NIGHT SETBACK	ECONOMIZER	ENTHALPY	VENTILATION/RECIRCULATION	HUMIDITY CONTROL	SETPOINT TEMPERATURE RESET	CHILLER DEMAND LIMIT	CONDUCTIVITY CONTROL	PRESSURE CONTROL	FLOW CONTROL	ALARM INSTRUCTION
EXHAUST FAN EF-2																					
EXHAUST FAN DAMPER CONTROL							X	X	X												
EXHAUST FAN STATUS				X	X	X			X												X
EXHAUST FAN SPEED CONTROL																			X		
VFD FAULT ALARM	X								X												X
OUTSIDE AIR DAMPER (MD-1 & 2) CONTROL										X		X		X							
OUTSIDE AIR DAMPER (MD-3 & 4) CONTROL										X		X		X							
SPACE TEMPERATURE				X	X					X											X
SPACE STATIC PRESSURE				X	X							X		X					X		X
REFRIGERANT WARNING	X								X												X
REFRIGERANT ALARM	X								X												X
FAN COIL UNITS (FCU-1)																					
SPACE TEMPERATURE				X	X					X											X
FAN START/STOP							X	X													
FAN STATUS	X					X															X
CHILLED WATER CONTROL VALVE										X											
SUPPLY AIR TEMPERATURE				X	X					X											X

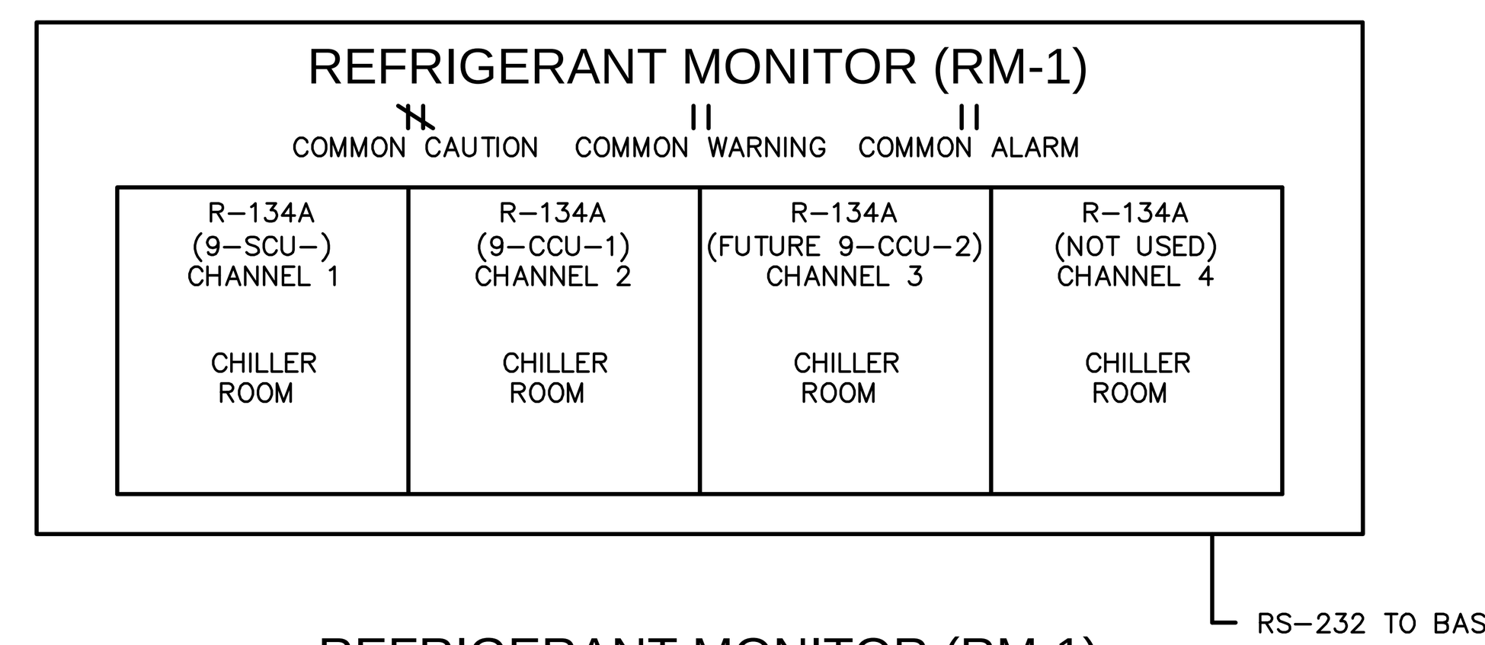
SOFTWARE – LOGS

SYSTEM/POINT DESCRIPTION	ALL POINTS LOG	ALARM SUMMARY LOG	STATUS SUMMARY LOG	TIME EVENT LOG	TREND LOG	POWER FAILURE MODE	COMMUNICATIONS FAILURE MOFE	NEW (N) EXISTING (E) POINT	REMARKS
EXHAUST FAN EF-2									
EXHAUST FAN DAMPER CONTROL	X			X		C	C	N	ALT. BID NO. 3
EXHAUST FAN STATUS	X	X	X	X	X			N	ALT. BID NO. 3
EXHAUST FAN SPEED CONTROL	X				X	C	N	N	ALT. BID NO. 3
VFD FAULT ALARM	X	X		X				N	ALT. BID NO. 3
OUTSIDE AIR DAMPER (MD-1 & 2) CONTROL	X				X	C	N	N	ALT. BID NO. 3
OUTSIDE AIR DAMPER (MD-3 & 4) CONTROL	X				X	C	N	N	ALT. BID NO. 3
SPACE TEMPERATURE	X	X		X	X			N	ALT. BID NO. 1
SPACE STATIC PRESSURE	X	X	X		X			N	ALT. BID NO. 1
REFRIGERANT WARNING	X	X		X				N	ALT. BID NO. 1
REFRIGERANT ALARM	X	X		X				N	ALT. BID NO. 1
FAN COIL UNITS (FCU-1)									
SPACE TEMPERATURE	X	X			X			N	ALT. BID NO. 2
FAN START/STOP	X		X	X		O	C	N	ALT. BID NO. 2
FAN STATUS	X				X			N	ALT. BID NO. 2
CHILLED WATER CONTROL VALVE	X				X	C	N	N	ALT. BID NO. 2
SUPPLY AIR TEMPERATURE	X	X			X			N	ALT. BID NO. 2

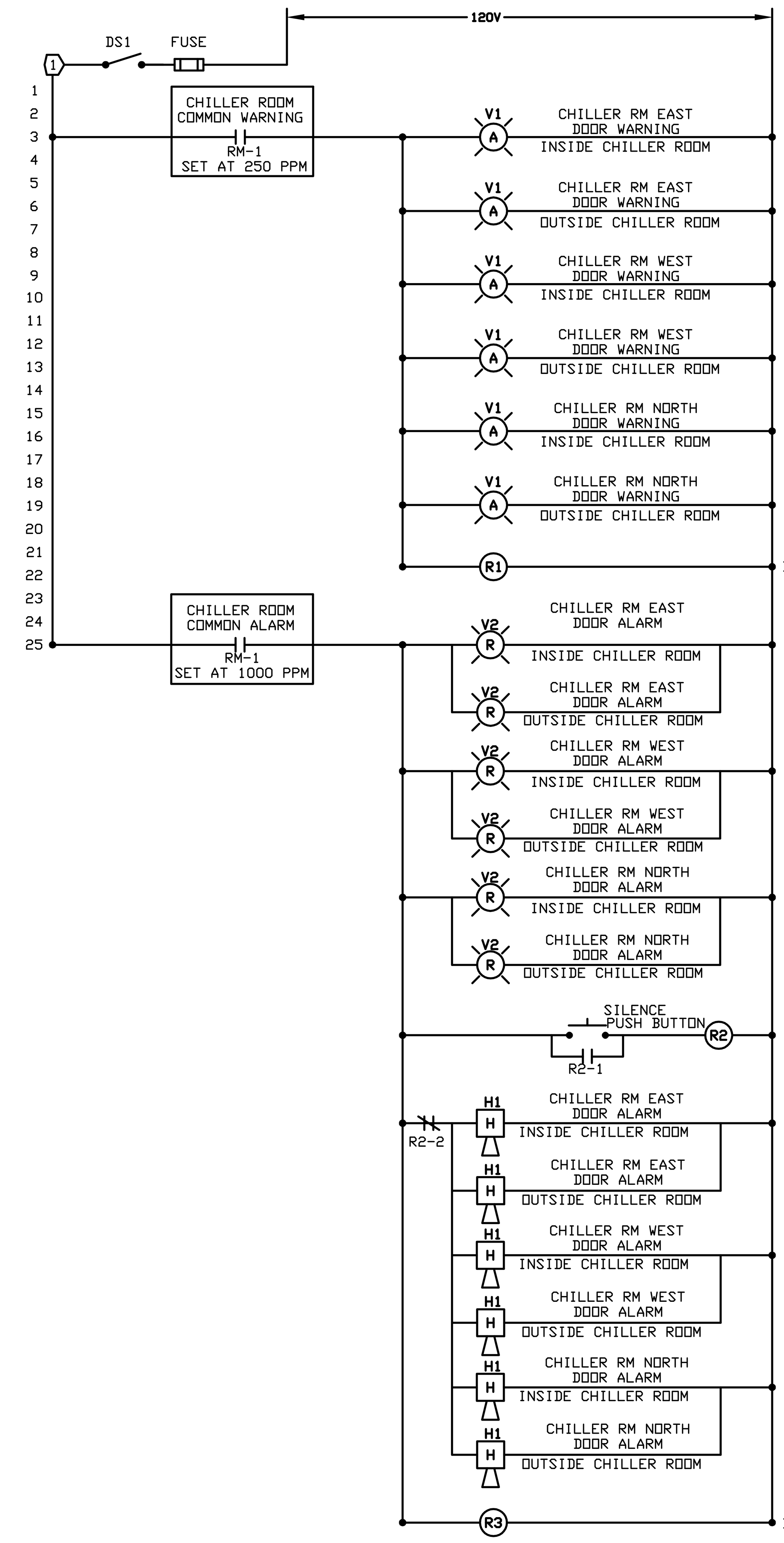
CODES FOR FAILURE MODE:
H – HIGH VALUE O – ON OR OPEN C – LAST COMMAND
L – LOW VALUE F – OFF OR CLOSED N – LOCAL LOOP

CONTROL DEVICE SCHEDULE

MARK	MANUFACTURER	MODEL	DESCRIPTION
RS-1	MSA		MULTICHANNEL GAS MONITORING SYSTEM WITH 4 CHANNELS, RS232 INTERFACE BOARD
V1	FEDERAL SIGNAL	141ST	120VAC ELECTROFLASH STROBE WARNING LIGHT (AMBER LENS)
V2	FEDERAL SIGNAL	141ST	120VAC ELECTROFLASH STROBE WARNING LIGHT (RED LENS)
H1	FEDERAL SIGNAL	SST-MV	120VAC ELECTRONIC SIREN, 108 dB SOUND LEVEL, NEMA 3R ENCLOSURE
DS1			CONTROL POWER DISCONNECT SWITCH
R1, R2, R3	IDEC		120VAC RELAY, 4PDT



REFRIGERANT MONITOR (RM-1)



REFRIGERANT MONITORING SYSTEM CONTROL PANEL WIRING DIAGRAM

Revisions | Date

SCHENDT ENGINEERING CORPORATION
CONSULTING ENGINEERS
* PH. (719) 637-8850 * * FAX (719) 632-0300 *
sec@secengr.com
2912 BEACON ST. COLORADO SPRINGS, CO 80907

GONZALES CONSULTING & ENGINEERING

P.O. Box 17868
Golden, Colorado 80402
Ph: 303.386.3324
Fx: 720.920.9004
RICARDO@GCECOLORADO.COM

Drawing Title	MECHANICAL CONTROLS
Project Title	REPLACEMENT OF ABSORPTION CHILLER
Project Number	VA259-12-C-0219
Building Number	BLDG 9
Approved: Medical Center Director	–
Approved: Assistant Administrator, Engineering Department	–
Location	2121 NORTH AVENUE GRAND JUNCTION, CO 81505
Date	03/13/2013
Checked	TBS
Drawn	DJS
Drawing Number	H13
	Dwg. 3 of 16

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Department of Veterans Affairs